

REMARKS

By this amendment, Applicants have canceled claims 4, 13 and 14 without prejudice or disclaimer and have amended claims 5 and 8-11 (which previously dependent from now canceled claim 4) to depend from independent claim 1. Claim 15 has been amended to correct a typographical error.

Entry of this Amendment under 37 CFR 1.116 is requested. Initially, it is submitted the amendments place the application in condition for allowance for the reasons set forth hereinafter or, at least, in better form for consideration on appeal by materially reducing or simplifying the issues in that the amendments cancel one of the independent claims previously in the application. Moreover, the foregoing amendments merely cancel claims and change the dependency of claims, and do not introduce new issues requiring further consideration and/or search. Therefore, entry of this amendment under 37 CFR 1.116 is proper.

Claims 1, 3-8 and 11-18 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,665,491 to Tomiyama et al. in view of U.S. Patent No. 5,219,680 to Fauteux. Applicants traverse this rejection and request reconsideration thereof.

The present invention is directed to an electrochemical energy storage device, e.g., a lithium secondary battery, in which a positive electrode capable of occluding/emitting a metal ion, e.g., lithium, and a negative electrode capable of occluding/emitting a metal ion, e.g., lithium, are formed via an electrolyte. It is characterized in that positive electrode active material and/or negative electrode active material carries activated carbon. In another aspect of the present invention, the positive and negative electrode collectors can be made of a carbon material (preferably activated carbon).

By adding or using activated carbon having a large surface area to or in the positive electrode active material, or the negative electrode active material, and preferably the collector, the reactive surface area is increased. Thus, an electric double-layer capacitance can be acquired due to the adsorption and desorption of cations and anions to and from the surface thereof, whereby higher capacitance can be achieved. Furthermore, by adding activated carbon to the active material of the lithium secondary battery of the present invention an expanded operating voltage range of 0 to 4.2 V can be achieved, and even higher capacitance can be achieved in the expanded operating voltage range. Further, by using carbon material (preferably activated carbon) in the collector, the collector is not eluted in the presence of electrolyte during charging or discharging in a wide operating voltage range, thereby enabling the operating voltage range to be expanded.

The patent to Tomiyama et al. discloses a nonaqueous secondary battery comprising a positive electrode sheet having a current collector, an electrode material mixture layer containing a lithium-containing transition metal oxide as a positive electrode active material, a negative electrode sheet having on a current collector and an electrode material mixture layer containing a negative electrode material capable of intercalating and deintercalating lithium, and a nonaqueous electrolyte containing a lithium salt. While the patent to Tomiyama et al. discloses carbon material as an example of a collector for a battery, this patent does not disclose that the active material carries activated carbon.

Merely using a porous carbon material in the collector, as in Tomiyama et al., does not ensure a higher operating voltage as can be obtained by the present invention. Moreover, the Tomiyama et al. patent discloses that the operating voltage range is from 2.8 to 4.0 V, but does not disclose a lower limit of the

operating voltage range of 0-2 V, as set forth in claim 1.

The patent to Fauteux discloses an invention relating to a negative electrode in a lithium secondary battery. The patent discloses that the negative electrode active material contains a polymer and an amorphous carbon (column 1, line 65). Activated carbon is shown as an example of the amorphous carbon (column 2, line 36). While Fauteux briefly discloses another embodiment in which amorphous carbon is added to both the anode and cathode (column 5, line 59), the amorphous carbon (activated carbon) is added as conductive agent, and thus there is no description that the electric double-layer capacitance can be improved.

While the Examiner alleges it would have been obvious to incorporate the activated carbon of Fauteux into the active material of Tomiyama et al., it is submitted one of ordinary skill in the art reading the teachings of these patents, would not have combined the teachings in the manner alleged by the Examiner. In this connection, the Fauteux patent discloses dispersing amorphous carbon in a polymeric matrix containing an interpenetrating ionically conducting liquid having an alkali metal salt dissolved therein. In contrast, a completely different active material is described in Tomiyama et al. The Tomiyama et al. patent does not use an electrode made of a polymeric matrix containing an interpenetrating ionically conducting liquid having an alkali metal salt dissolved therein. Accordingly, one of ordinary skill in the art would not have been motivated to disperse amorphous carbon in the electrodes of Tomiyama et al.

Moreover, there is no suggestion that combining the teachings of Tomiyama et al. and Fauteux would provide a wider operating voltage range, such as that presently claimed.

For the foregoing reasons, it is submitted the presently claimed invention is

patentable over the proposed combination of Tomiyama et al. and Fauteux.

Claims 9 and 10 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Tomiyama et al. in view of Fauteux and further in view of JP 9-259891. Applicants traverse this rejection and request reconsideration thereof.

JP 9-259891 discloses a nonaqueous electrolyte secondary battery and has been cited by the Examiner as allegedly disclosing positive and negative electrode collectors and active materials being held on a plastic or metallized plastic sheet. However, clearly nothing in JP 9-259891 remedies any of the basic deficiencies noted by with respect to Tomiyama et al and Fauteux. Accordingly, claims 9 and 10 are patentable over the proposed combination of references.

In view of the foregoing amendments and remarks, entry of this amendment and favorable reconsideration and allowance of all of the claims now in the application are requested.

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Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP


Alan E. Schiavelli
Registration No. 32,087

AES/at
(703) 312-6600